

4.9 GHz Meeting

Federal Communications Commission Wireless Telecommunications Bureau

Washington, DC
November 4, 2003

WHO/WHAT IS NPSTC?

- *National Public Safety Telecommunications Council*
- Federation of 13 national public safety associations, with liaison from 5 Federal agencies/groups
- Supported by US DOJ's AGILE Program
- Follow-on to PSWAC, and NCC after July 2003
- Oversight group for many national PS communications issues:
 - Major regulatory issues (700 MHz, 800 re-banding, 4.9 GHz)
 - Investigating & promoting new and innovative technologies

Mobility for Emergency & Safety Applications (Project MESA)

- Joint North American – European Group
 - Organizational Partners: ETSI and TTA
 - Twenty-three countries on all continents
- Purpose: *Establish International Wireless Broadband Standards for PPDR*
- Statement of Requirements completed
- Focus statement from Ottawa 2003:

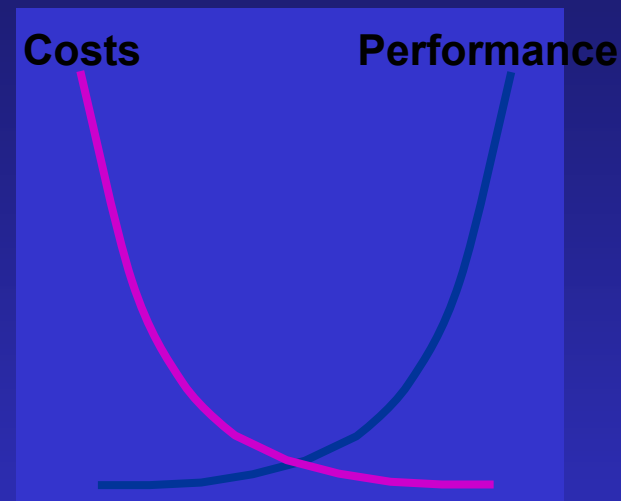
“The Technical Specifications Group will be developing MESA specifications based upon existing and emerging technologies, including IPv6 and OFDM.”

4.9 GHz Band

- First ever PS assignment of broadband spectrum
- NPSTC 4.9 Task Force (Chair: Steve Devine, MHP)
- Problems of managing this band
 - Minimum of 4 overlays of systems by FCC licensing
- Interoperability or interference?
 - The need for an interoperable standard
- Potential technologies for ISO Layers 1 – 3/4
 - IEEE 802.11a/j and/or DSRC (Layers 1 & 2)
 - Mobile Adhoc Networks (MANET – Layers 2/3 & 4)

Why Now? Colliding Exponentials

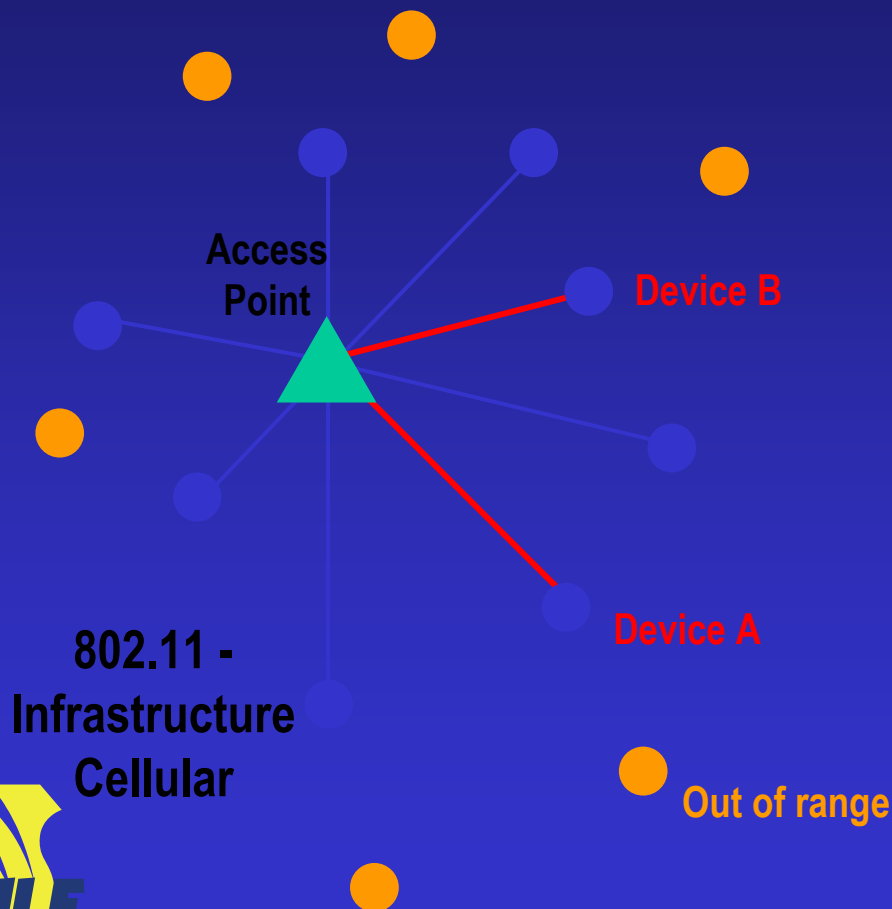
- Exponential Interactions
 - Moore's Law
 - Reed's Law = Networked Communities
 - Value of the network is 2^n
 - Bandwidth Cost
 - 802.11 (\$1/Mbps)
 - Storage Cost
 - \$1/GB
- Proliferation of embedded and networked computational devices (sensors, PDA's, handsets, laptops, etc.)
- What will change most is how people communicate with each other and with the environment
 - Machine-to-machine
 - Human-to-human
 - Human-to-machine
 - Machine augmented communications



Relevant Emerging Behaviors

- Unmetered connectivity significantly increases usage (studies of DSL and Cable modem usage show major shift in usage patterns)
- People (and devices) will access “the network” and each other in different ways at different times depending on their needs and context:
 - Social interactions
 - Gaming/Entertainment
 - Service availability and cost
 - Human interaction supported by devices
 - Information creation and sharing
 - Private group collaboration
 - Always-on conference call

Comparison of Networks-Traditional



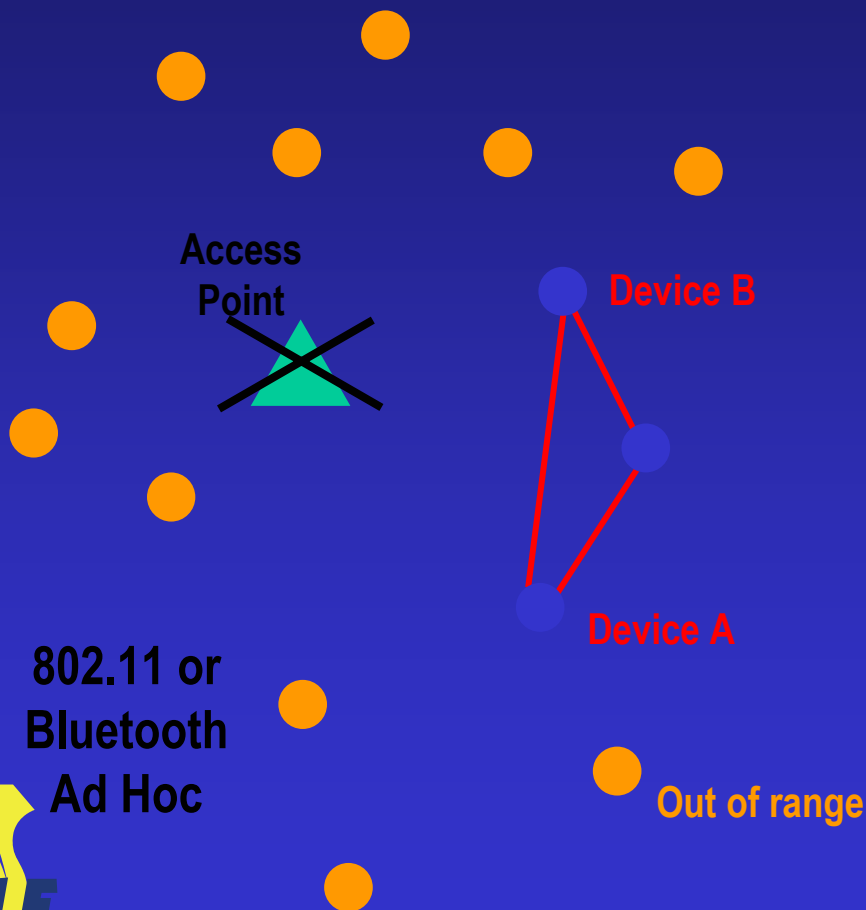
Pros

- ⊕ Centralized management
- ⊕ Designed for client-server
- ⊕ One hop to base station
- ⊕ “Standard” wireless LAN

Cons

- ⊕ Limited Range
- ⊕ Requires Line-of-sight to access point
- ⊕ All traffic through base station – single point of failure
- ⊕ Does not scale beyond access point’s capacity

Comparison of Networks-Ad Hoc



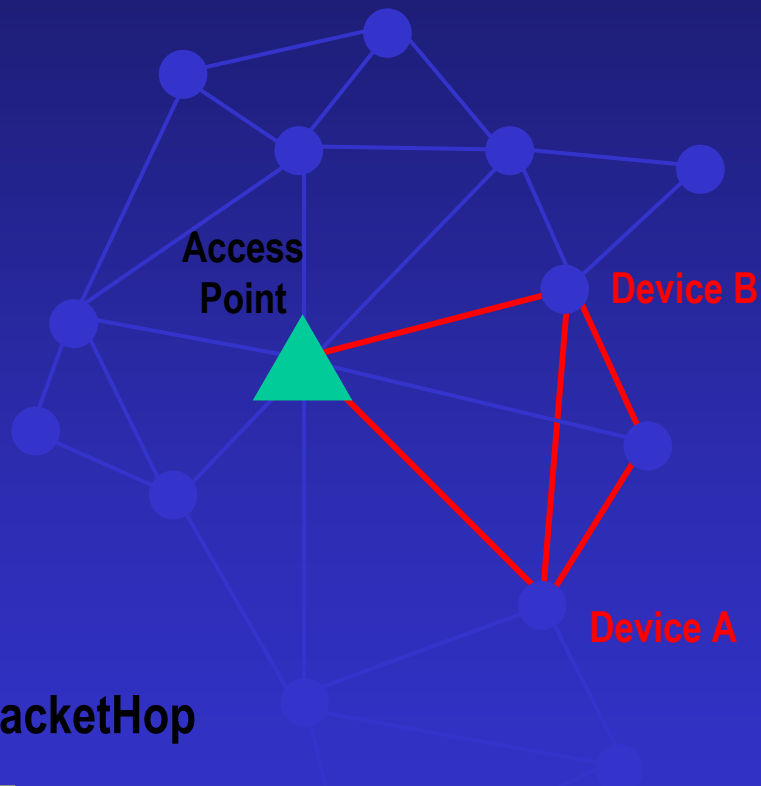
Pros

- ⊕ Ad Hoc
- ⊕ Peer-to-peer
- ⊕ One hop to each node

Cons

- ⊕ Limited Range
- ⊕ Requires Line-of-sight to other nodes
- ⊕ Does not scale beyond local capacity
- ⊕ Not compatible with "standard" wireless LAN

Comparison of Networks - PacketHop



Pros

- ⊕ Ad Hoc
- ⊕ Peer-to-peer
- ⊕ Self-forming, self-healing
- ⊕ Many routes to each node
- ⊕ Extended range (multi-hop)
- ⊕ Scalable
- ⊕ Does not require line-of-sight
- ⊕ Can be compatible with "standard" wireless LAN
- ⊕ Mobile, dynamic

Cons

- ⊕ No central control
- ⊕ Requires new security mechanisms

Distributed Crisis Management

Flexible, immediate situation awareness

- Public Safety Applications

- EMS, fire & law enforcement
- Emergency management
- Crises management
- Tactical training
- Dynamic logistics
- Plant operations & security
- Physical security
- Hazardous material events
- Urban & wild-land fire suppression



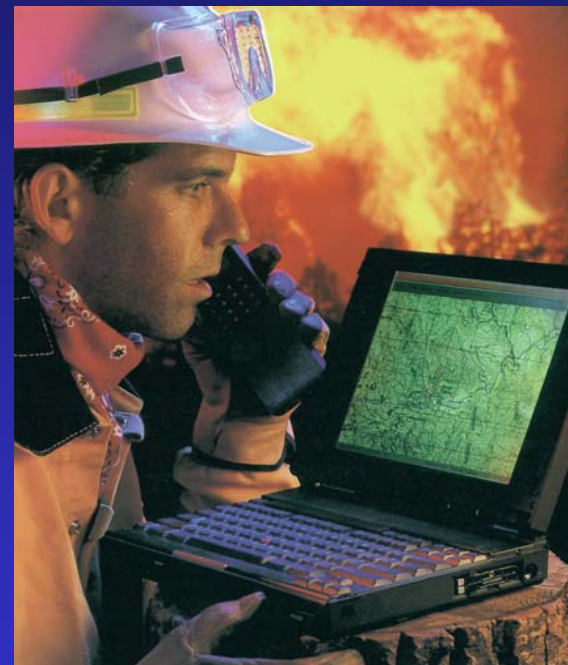
“We knew we wanted interoperability and broadband communications. . . I did not realize how realistic our goals were and how comparatively inexpensive until I met the PacketHop Team.”

Michael Griffin, Deputy Chief, CA Governor’s Office of Emergency Services

MANETs for Public Safety

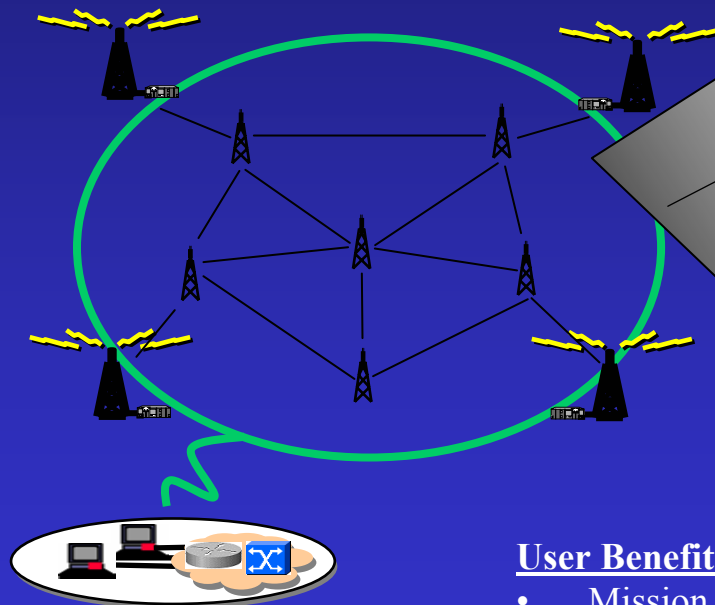
Network Centric Response

- Rapidly set up and deployment
- Local & distributed Command and Control
 - Situational Awareness
 - People and asset tracking & management
- Multi-hop to avoid building obstructions and line of sight challenges
 - Highly mobile users, “bread crumbs”
 - Interoperable IP-based
 - Greater efficiencies in spectrum utilization
- Low costs due to leverage of off-the-shelf computing and networking equipment
- Highly reliable
 - Redundant packet routes
 - No single point of failure

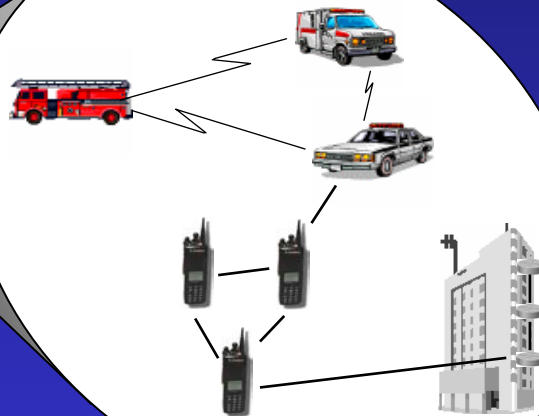


Public Safety Network Concepts

Fixed MANET



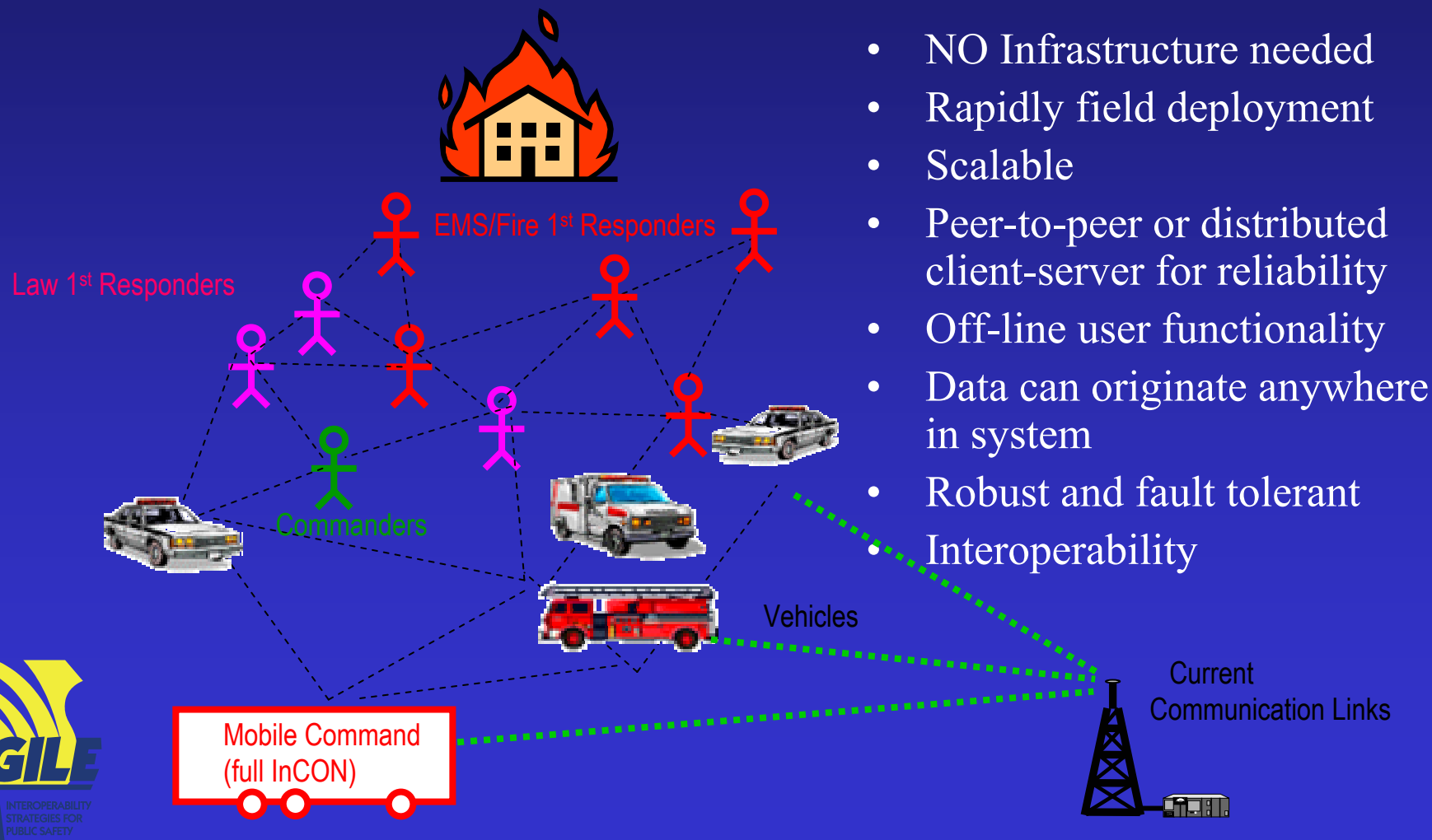
Mobile MANET



User Benefits

- Mission critical adaptive infrastructure
 - In-building coverage
 - Backup to existing infrastructure
 - Bandwidth efficiency
- IP based network interoperability
- Broadband data network (leveraging 802.11)

Public Safety First Responders



National Public Safety Telecommunications Council

DD 1380 Readiness SF 600



BMIST v0.9.6 4:40p

Last Name, First Name
Snuffy, Joe

SSN 111-11-1111

☐ BI ☐ NBI ☒ Disease ☐ Psych

☐ Airway
☐ Head
☐ Wound
☐ Neck
☐ Burn
☐ Amputation
☐ Stress
☐ Other
Specify Other:

back left shoulder **Store**

Summary
stress to back left shoulder

Level of Consciousness

Pain Response

Pulse 100 Time 16:31

Tourniquet No Time

Morphine Yes Time 16:32

Dose

IV Time

Treatment

Disposition **Returned To Duty**

Provider Christine L Streeter

Date/Time 12/11/2001 @ 16:06

Save Save and Transmit

Start Edit Tools

BMIST v0.9.6 5:13p

Name: Snuffy, Joe X

Grade: E5 SSN: 111-11-1111 Race: White

DOB: 12/12/1970 Blood: A+ Sex: Male

Religion: Catholic Height: 58 Weight: 180

Unit: TATRC MOS/AOC:

Flight Status: Flight PRP:

P U L S E S
1 1 1 1 1 1 Sep 2001

Date of Last:
Physical exam: 1 Sep 2001
Dental: 1 Sep 2001
Hearing: 1 Sep 2001
Eye exam: 1 Sep 2001
HIV: 1 May 2000
DNA:

Dental Health
Dental Readiness Classification: 2
Complete Dental
Central Panographic Storage
Facility:
Date Verified:

Allergy
Allergies (incl.
Pollen, Penicillin

Medical Warning

Date

Save Save and Transmit

Start Edit Tools

BMIST v0.9.6 4:55p

Last Name, First Name
Snuffy, Joe

SSN 111-11-1111

☐ BI ☐ NBI ☐ Disease ☐ Psych

Temp 98
Pulse 80
Resp 22
Blood Pres S 120
D 80
SP02 98

Subjective

Objective

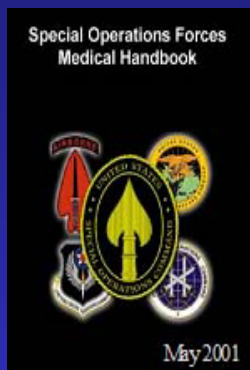
Assessment Code

Plan

Disposition
Provider Christine L Streeter
Date/Time 12/11/2001 @ 16:55

Save Save and Transmit

Start Edit Tools



4.9 GHz Band – NPSTC Petition

- 4.9 GHz Task Force (Chair: Steve Devine, MHP)
- Problems of managing this band
 - 4+ overlays of systems by FCC licensing
- Interoperability or interference?
 - The need for a standard
 - Importance of RPCs and a “National Model Plan”
- Potential technologies
 - IEEE 802.11a/j and DSRC (severely limited by FCC masks)
 - Mobile Adhoc Networks (MANET)

NPSTC 4.9 GHz Mask Position

- Supports everyday local/state scenarios & topologies
 - Uses proven public safety scene management experience
- Supports IP-based shared systems, not stovepipes
- Uses COTS equipment, not just COTS chipsets
 - 150M units/yr commercial products shipped by 2007
 - Anticipated total public safety market of 2M units by 2007
- Only modifications are to firmware & operating band
 - Changes to MAC/Network layers for public safety needs

Standards Development Activities

- IETF
 - Many research teams submit drafts
 - Nokia, INRIA, Rice Univ, SRI, UCLA, Cornell, Cisco, CMU,
 - 1999 IETF forms Mobile Ad hoc Networks (MANET) working group to develop new routing protocols
 - Teams = Nokia, Rice Univ, INRIA and SRI
 - 2003 MANET WG selects 4 protocols for RFC and requests four research teams to consolidate into 1 protocol
- DSRC
 - DOT and ISO adopt 802.11a R/A for vehicle communications → 802.11p
- IEEE
 - 1999 single-hop ad hoc mode for 802.11 (LANs)
 - 2003 investigating multi-hop ad hoc for 802.15 (PANs) and 802.16 (MANs)

Required Public Safety Enhancements Within IEEE 802 Standards Suite

- Security
 - Data layer security is OK today
 - Network security not being addressed
- Performance modifications for specific network architectures
 - Uni-directional links
 - Multiple simultaneous routes
 - Dynamic network membership
 - Hierarchical/command data management
 - Power control
- Quality of Service (QoS)
 - Channel and data prioritization

NPSTC Statement to the FCC¹

- The Commission should embrace a standards process as a further activity within this proceeding that will lead to the adoption of an ANSI-recognized standard within a period of 18-24 months. To further this effort, NPSTC and Motorola will present a proposal to the Private Radio Section of the Telecommunications Industry Association (TIA) at its October 2003 meeting, asking TIA to assemble appropriate portions of existing IEEE and related standards into a comprehensive suite to meet public safety's specific broadband needs in the 4.9 GHz band. This suite will then be brought to the Commission as a recommendation for a mandatory standard for the 4.9 GHz band, thus promoting maximum coordinated use of the spectrum and supporting interoperability. Because of its ongoing work with Project 25 and the FCC's National Coordination Committee, TIA is particularly familiar with the unique requirements of public safety communications, having insight that is not present within other Standards Definition Organizations operating under the ANSI umbrella. By assembling existing standards into a specific suite for public safety wireless broadband use, the time required for independent standards development is eliminated.

¹ See *Further Comments of the National Public Safety Telecommunications Council Regarding Its Petition for Reconsideration* filed October 2, 2003 with the FCC as part of ongoing activities on WT Docket 00-32.

Proposed 4.9 GHz Standards Assembly Roadmap

1. Select the Physical Layer standard
2. Assemble the appropriate MAC Layer standards and standards options
 - Add Quality of Service (QoS), including a priority mechanism
 - Add power control functionality

Proposed 4.9 GHz Standards Assembly Roadmap

3. Consider MAC Layer enhancements, as appropriate
4. Develop IPv6-based routing protocols
 - Establish user requirements based upon AGILE SoR scenarios
 - Initiate open competition to select most appropriate standard

Proposed 4.9 GHz Standards Assembly Roadmap

5. Incorporate AGILE Authentication/IP Database requirements
6. Define Application Layer requirements based upon AGILE SoR
7. Review Application Layer requirements with Project MESA

National Authentication/IP Database

- Initially requested by NCC I/O Subcommittee
- Need highlighted by NPSTC 4.9 Task Force
- Tentative funding by NIJ/AGILE for proof of concept and potential testbed(s)
- Interest expressed by DHS OS&T

National Authentication/IP Database

- Concept/Requirements
 - Authentication and certificate storage
 - Routing information
 - IP address repository for PS devices
 - Data (MDT, PDA, etc)
 - Voice (IP radios such as OpenSky/P25 data)
- Initial funding of feasibility study & testbed

In Summary ...

1. NPSTC supports a realistic mask for affordable equipment, leveraging wider market economics
2. NPSTC is leading the public safety effort to assemble a standards package that can be adopted by the FCC as mandatory for the 4.9 GHz band
 - TIA Private Radio Section has agreed to assist NPSTC in this effort using available/in-progress standards
3. NPSTC is preparing a generic 4.9 RPC Guide